National Advisory Committee for Aeronautics

Research Abstracts

CURRENT NACA REPORTS

NACA Rept. 1075

DEC 9 1955

HYDRODYNAMIC IMPACT OF A SYSTEM WITH A
SINGLE ELASTIC MODE. II-COMPARISON OF
EXPERIMENTAL FORCE AND RESPONSE WITH
THEORY. Robert W. Miller and Kenneth F.
Merten. 1952. ii, 7p. diagrs., photos., tab.
(NACA Rept. 1075. Formerly TN 2343)

Hydrodynamic impact tests were made on an elastic
model approximating a two-mass-spring system
which had a ratio of sprung mass to hull mass of
0.6 and a natural frequency of 3.0 cycles per
second. Tests were made at two combinations of
trim and flight-path angles and for a range of flight-
path velocity. Comparison of the experimental
results with results obtained from the theory of
NACA TN 1398 showed good agreement.

NACA Rept. 1078

EFFECTS OF COMPRESSIBILITY ON THE PER-
FORMANCE OF TWO FULL-SCALE HELICOPTER
ROTORS. Paul J. Carpenter. 1952. ii, 8p. diagrs.,
photo. (NACA Rept. 1078. Formerly TN 2277)

An investigation has been conducted on the Langley
helicopter test tower to determine experimentally
the effects of compressibility on the performance and
blade pitching moments of two full-scale helicopter
rotors with twisted and untwisted blades over a tip-
speed range from 350 to 770 feet per second.

NACA Rept. 1081

A STUDY OF SECOND-ORDER SUPERSONIC FLOW
THEORY. Milton D. Van Dyke. 1952. ii, 23p.
diagrs. (NACA Rept. 1081. Formerly TN 2200)

Second-order solutions of supersonic-flow problems
are sought by iteration, using the linearized solution
as the first step. For plane and axially symmetric
flows, particular solutions of the iteration equation
are discovered which reduce the second-order prob-
lem to an equivalent linearized problem. Compari-
son of second-order solutions with exact and numeri-
cal results shows great improvement over linearized
theory. For full three-dimensional flow, only a
partial particular solution is found. The inclined
cone is solved, and the possibility of treating more
general problems is considered.

NACA Rept. 1089

SINGLE-DEGREE-OF-FREEDOM-FLUTTER
CALCULATIONS FOR A WING IN SUBSONIC
POTENTIAL FLOW AND COMPARISON WITH AN
EXPERIMENT. Harry L. Runyan. 1952. ii, 8p.
diagrs. (NACA Rept. 1089. Formerly TN 2396)

The effect of Mach number and structural damping
on single-degree-of-freedom pitching of a wing is
presented. Some experimental results are com-
pared with theory and good agreement is found for
certain ranges of an inertia parameter.

NACA TN 2926

STATIC FORCE-DEFLECTION CHARACTERISTICS
OF SIX AIRCRAFT TIRES UNDER COMBINED
LOADING. Walter B. Horne. May 1953. 92p.
diagrs., photos., 2 tabs. (NACA TN 2926)

Static force-deflection tests were made on six air-
craft tires. These tests included the vertical load-
ing of the six tire specimens, combined vertical
loading and side loading and combined vertical load-
ing and torsional loading of five tire specimens, and
combined vertical loading and fore-and-aft (longitu-
dinal) loading of one tire specimen for different
initial inflation pressures. Tire deflection, vertical-
load center-of-pressure shifts, and tire pressure
measurements are presented for the different load
combinations. The lateral spring constants for all
the tire specimens tested decreased with increasing
vertical tire deflection; whereas, the torsional and
fore-and-aft spring constants increased with increas-
ing vertical tire deflection. The lateral and fore-
and-aft shifts of the vertical-load center of pressure
were found to average 75 percent and 25 percent,
respectively, of the side and fore-and-aft tire de-
flections.

NACA TN 2927

DEFLECTION OF DELTA WINGS HAVING A CARRY-
THROUGH-BAY CHORD SMALLER THAN THE WING
ROOT CHORD. Roger W. Peters and Manuel Stein.
May 1953. 25p. diagrs., photo., 2 tabs. (NACA
TN 2927)

Experimentally determined influence coefficients are
presented for the deflection of two solid delta wings -
one wing of constant thickness and the other of con-
stant thickness ratio - having a carry-through-bay
chord smaller than the wing root chord. A theoreti-
cal method of analysis is demonstrated for the con-
stant thickness wing under tip load, and the theoreti-
cal results are compared with the experimental
results.

NACA TN 2928

AXIAL-LOAD FATIGUE PROPERTIES OF 24S-T
AND 75S-T ALUMINUM ALLOY AS DETERMINED
IN SEVERAL LABORATORIES. H. J. Grover and
W. S. Hyler, Battelle Memorial Institute, Paul Kuhn
and Charles B. Landers, Langley Aeronautical
Laboratory and F. M. Howell, Aluminum Company
of America. May 1953. 63p. photos., diagrs.,
7 tabs. (NACA TN 2928)

In the initial phase of an NACA program on fatigue
research, axial-load tests on 24S-T3 and 75S-T6
aluminum-alloy sheet have been made at the Battelle
Memorial Institute and at the Langley Aeronautical
Laboratory of the NACA. The test specimens were
polished and unnotched. The manufacturer of the
material, the Aluminum Company of America, has
made axial-load tests on 24S-T4 and 75S-T6 rod
material. The test techniques used at the three
laboratories are described in detail; the test results
are compared with each other and with results ob-
tained on unpolished sheet by the National Bureau of
Standards.

NACA TN 2929

EXPERIMENTAL INVESTIGATION OF THE EFFECT
OF REAR-FUSELAGE SHAPE ON DITCHING BE-
HAVIOR. Ellis E. McBride and Lloyd J. Fisher.
April 1953. 35p. diagrs., photos., 3 tabs. (NACA
TN 2929)

An experimental investigation was conducted to
determine the effect of rear-fuselage shape on
ditching behavior. The basic fuselages were
streamline bodies of revolution of fineness ratios 6
and 9. Variations in longitudinal curvature were
obtained by sweeping up or sweeping down the rear
half of the center line. A change in the cross sec-
tion was obtained by splitting the center line in the
plan view. The models were landed in calm water
at speeds of 30, 40, 50, and 60 feet per second.
The effects on ditching behavior of changes in longi-
tudinal curvature, cross section, fuselage fineness
ratio, and landing speed are presented in terms of
maximum height of the center of gravity, maximum
attitude, length of run, and skipping tendency.

NACA TN 2932

WATER-LANDING INVESTIGATION OF A FLAT-
BOTTOM V-STEP MODEL AND COMPARISON WITH
A THEORY INCORPORATING PLANING DATA.
Robert W. Miller. May 1953. 23p. diagrs., photo.,
2 tabs. (NACA TN 2932)

This paper presents the results of a fixed-trim
smooth-water impacts of a flat-bottom V-step model
having a high beam loading. Plots of nondimensional
load, draft, vertical velocity, and time against flight-
path angle at water contact show results similar to
those exhibited by other models having transverse
steps, high beam loadings, and different shapes.
Time-history comparisons show good agreement be-
tween experimental results and results computed by
the method of NACA TN 2814 for the V-step case.

NACA TN 2934

RELATION BETWEEN ROUGHNESS OF INTERFACE
AND ADHERENCE OF PORCELAIN ENAMEL TO
STEEL. J. C. Richmond, D. G. Moore, H. B.
Kirkpatrick and W. N. Harrison, National Bureau of
Standards. April 1953. 29p. diagrs., photos.,
7 tabs. (NACA TN 2934)

The relationship between adherence and roughness of
interface between enamel and iron was studied.
Porcelain-enamel ground coats were prepared and
applied under conditions that gave various degrees of
adherence. The variations were produced by
(a) varying the amount of cobalt-oxide addition in the
frit; (b) varying the type of metallic-oxide addition
in the frit, keeping the amount constant at 0.8 weight
percent; (c) varying the surface treatment of the
metal before application of the enamel, by pickling,
sandblasting, and polishing; and (d) varying the time
of firing of the enamel containing 0.8 percent of
cobalt oxide. A positive correlation was found be-
tween adherence and roughness of the interface.

NACA TN 2936

COMBUSTION INSTABILITY IN AN ACID-HEPTANE
ROCKET WITH A PRESSURIZED-GAS PROPELLANT
PUMPING SYSTEM. Adelbert O. Tischler and
Donald R. Bellman. May 1953. 50p. diagrs., photo.
(NACA TN 2936. Formerly RM E51G11)

The low-frequency instability problem of a rocket
using liquid propellants and a pressurized-gas
propellant pumping system was experimentally inves-
tigated with a 300-pound thrust acid-heptane rocket.
The results were compared to results predicted by
an analysis based on the premise that the instability
was due to an out-of-phase coupling between pro-
pellant flow and combustion-chamber pressure. The
calculated instability frequency conformed with those
observed experimentally and the analysis predicted
many of the observed trends of varying rocket de-
sign or operating parameters.

NACA TN 2937

METHOD FOR CALCULATING THE ROLLING AND
YAWING MOMENTS DUE TO ROLLING FOR UN-
SWEPT WINGS WITH OR WITHOUT FLAPS OR
AILERONS BY USE OF NONLINEAR SECTION LIFT
DATA. Albert P. Martina. May 1953. 41p. diagrs.,
11 tabs. (NACA TN 2937)

The methods of NACA Reports 865 and 1090 have
been applied to the calculation of the rolling- and
yawing-moment coefficients due to rolling for un-
swept wings with or without flaps or ailerons. The
methods allow the use of nonlinear section lift data
together with lifting-line theory. Two calculated
examples are presented in simplified computing
forms in order to illustrate the procedures involved.

NACA TN 2938

ANALYSIS OF HEAT ADDITION IN A CONVERGENT-DIVERGENT NOZZLE. Donald P. Hearth and Eugene Perchonok. April 1953. 18p. diagrs. (NACA TN 2938)

The effect of heat addition to a divergent stream with initially sonic flow is analyzed and the variation of exit Mach number, static pressure, and total pressure is presented. Application of these results to the diverging portion of a convergent-divergent nozzle indicated that nozzle heat addition delays nozzle overexpansion and affects the jet thrust appreciably. Moreover, misleading nozzle coefficients will be computed if heat addition in the nozzle is ignored.

NACA TN 2939

OPTIMUM CONTROLLERS FOR LINEAR CLOSED-LOOP SYSTEMS. Aaron S. Boksenbom, David Novik and Herbert Heppler. April 1953. 27p. diagrs. (NACA TN 2939)

An analysis is made for optimum controllers of general, linear, time-invariant multiloop systems based on minimizing the mean squares or integral squares of errors and constrained variables for either stationary statistical or transient inputs. A general method of using open-loop optimum filter theory is derived that assures structural stability of the closed-multiloop system during the optimization process. General solutions were obtained for certain special cases and applied to examples of turbojet engine control.

NACA TN 2940

EFFECT OF HIGH BULK TEMPERATURES ON BOUNDARY LUBRICATION OF STEEL SURFACES BY SYNTHETIC FLUIDS. S. F. Murray, Robert L. Johnson and Edmond E. Bisson. May 1953. 27p. diagrs., photos., 2 tabs. (NACA TN 2940)

An experimental study was made of the effect of high lubricant bulk temperatures on the boundary lubricating effectiveness with steel surfaces of various types of synthetic fluids considered as lubricants for turbine engines. Synthetic fluids were generally effective lubricants at higher temperatures than comparable petroleums. Lubrication with esters and possibly other fluids is believed to result from formation of a chemisorbed soap film by free acids (contaminants) in the fluid. Failure results from deterioration of metal soap and oxide films, which is influenced by temperature effects on the bulk fluid. Thermal stability can be associated with viscosity grade within a given class; however, no correlation could be made between lubrication failure temperature and the viscosity at failure temperatures for the various fluids. At temperatures up to its decomposition point, a silicate ester showed more promise than the other lubricants studied.

NACA TN 2944

THE ZERO-LIFT DRAG OF A SLENDER BODY OF REVOLUTION (NACA RM-10 RESEARCH MODEL) AS DETERMINED FROM TESTS IN SEVERAL WIND TUNNELS AND IN FLIGHT AT SUPERSONIC SPEEDS. Albert J. Evans. April 1953. 40p. diagrs., tab. (NACA TN 2944)

Presents zero-lift drag data of an NACA RM-10 slender body of revolution with and without stabilizing fins attached. The results from several wind tunnels and in flight are compared. The results cover a Reynolds number range from about 1×10^6 to 40×10^6 for the wind-tunnel models and 12×10^6 to 140×10^6 for the flight models. The Mach numbers covered include 1.5 to 2.4 in the wind tunnels and 0.85 to 2.5 in flight.

NACA TN 2948

INVESTIGATION OF LATERAL CONTROL NEAR THE STALL. FLIGHT INVESTIGATION WITH A LIGHT HIGH-WING MONOPLANE TESTED WITH VARIOUS AMOUNTS OF WASHOUT AND VARIOUS LENGTHS OF LEADING-EDGE SLOT. Fred E. Weick, Maurice S. Sevelson, James G. McClure and Marion D. Flanagan, Agricultural and Mechanical College of Texas. May 1953. 61p. diagrs., photos., 4 tabs. (NACA TN 2948)

Flight tests were made with a light high-wing monoplane to investigate possibilities for obtaining satisfactory lateral control at low flight speeds. The airplane was tested with a plain straight wing, with the wing twisted to various amounts of washout, and with leading-edge slots covering various portions of the span. With each wing configuration the tests were repeated with power on and off and for three center-of-gravity locations. The flow over the wing was observed by means of tufts attached to the upper surface. The results of the tests indicate that reliable control at angles of attack very near the stall can be achieved by the proper use of leading-edge slots and wing washout.

NACA TM 1347

REPORT ON THE SPECIAL FIELD "INTERFERENCE" TO THE WIND-TUNNEL COMMITTEE IN FEBRUARY 1945. (Bericht über das Fachgebiet Interferenz vor dem Windkanalausschuss im Februar 1945). H. Schlichting. Includes: Compilation of Interference Systematics at the Aerodynamic Institute of the Technical Academy Braunschweig. E. Moller. May 1953. 46p. diagrs. (NACA TM 1347. Trans. from Technische Hochschule Braunschweig. Aerodynamisches Institut. Bericht 45/4)

Contains an outline of investigations dealing with interference effects on the static stability of various airplane configurations that were conducted, were being conducted, and were started at the time of this present report. Results of several investigations are presented and discussed briefly. A supplement is attached showing the configurations tested and outlining the various test programs. Suggestions for future investigations are also included.

NACA TM 1353

SOME PROBLEMS OF THE THEORY OF CREEP.
(Nekotorye Voprosy Teorii Polzuchesti). Y. N.
Rabotnov. April 1953. 19p. diagrs. (NACA
TM 1353. Trans. from Vestnik Moskovskovo
Universiteta, no. 10, 1948, p.81-91).

A theory of creep is proposed which represents an
extension of the theory of elastic heredity of
Volterra to plastic deformation. The theory is
applied to the problems of relaxation, reverse
creep, creep-bending of bars, and creep of a pipe
under internal pressure. A special class of three-
dimensional problems, in which the relative magni-
tudes of the stresses at a point remain constant with
time, and likewise the relative magnitudes of the
strains, is also considered.

BRITISH REPORTS

N-21249 *

Forest Products Research Lab. (Gt. Brit.)
MOISTURE RELATIONS OF COMPOSITE WOOD
PRODUCTS. THE MOVEMENT OF PLYWOOD
(Part IV). PROGRESS REPORT TWENTY-THREE.
R. J. Newall and G. E. Soane. February 1953.
4p. (Forest Products Research Lab.)

This report gives data on the swelling of plywood
of 30 species. Routine measurements have been
made on the movement of samples of all species
tested for plywood manufacture.

N-21447 *

Department of Supply (Australia)
TORSION AND BENDING OF SWEPT AND TAPERED
WINGS WITH RIGID CHORDWISE RIBS. W. H.
Wittrick. September 1950. 85p. diagrs., 24 tabs.
(Department of Supply. ACA-51)

The problem considered is that of a swept wing,
either conical or cylindrical, of arbitrary section,
under any system of bending and torsion loads. The
wing is assumed to consist of a nonbuckling outer
skin, a series of booms and stringers located along
generators of the tube, and a series of closely
spaced ribs all parallel to the root section. The
ribs are assumed to be completely rigid in their own
planes but to offer no resistance to warping out of
their own planes. For simplicity only single-cell
tubes are considered.

N-21676 *

Forest Products Research Lab. (Gt. Brit.)
INVESTIGATIONS INTO GLUES AND GLUING.
PROGRESS REPORT SEVENTY-ONE - SEPTEMBER
1952. BEHAVIOUR OF GLUED WOOD PRODUCTS
IN LIGHT NAVAL CRAFT. THIRD YEAR'S
ANALYSIS. R. J. Newall and L. S. Doman. 6p.
(Forest Products Research Lab.)

This report presents a summary of results of
periodic inspections made during the previous three
years on glued wood products used in boats.

N-21803 *

Aeronautical Research Council (Gt. Brit.)
NO. 2, $11\frac{1}{2}$-FT WIND-TUNNEL TESTS OF A
SMALL SPAN, SMALL CHORD DOUBLE AILERON
FOR USE AS A LATERAL CONTROL ON A HIGH-
LIFT AIRCRAFT. A. D. Young and W. S. D.
Marshall. 1952. 32p. diagrs., 5 tabs. (ARC
R & M 2536; ARC 9565. Formerly RAE Aero 2111)

Tests were made on a 1/2.25-scale model of a half
wing of the Master. The span of the aileron was
0.22s and the chords were 0.2c̄ and 0.15c̄; the
aileron was fitted with a balance tab of 0.05c̄ chord.
Measurements were made of the hinge moments,
lift increments (from which the rolling moments
were deduced), and the pressures in the aileron gaps
just above and below the seals. The latter were
required for estimating the effect of internal
shrouded nose (or pressure) balances. Tests were
also made of the effect on the hinge and rolling
moments of a small spoiler situated just aft of the
front aileron vent; the spoiler was assumed to
emerge on the lower surface of the down-going
aileron and on the upper surface of the up-going
aileron.

N-21804 *

Aeronautical Research Council (Gt. Brit.)
INFLUENCE OF TUNED DAMPERS ON FLEXURE-
AILERON FLUTTER. Part I: THEORETICAL
INVESTIGATION ON THE INFLUENCE OF TUNED
DAMPING DEVICES ON FLEXURE-AILERON
FLUTTER. R. A. Frazer and W. P. Jones.
Part II: SOME FURTHER CALCULATIONS ON THE
INFLUENCE OF TUNED DAMPING DEVICES ON
FLEXURE-AILERON FLUTTER. W. P. Jones.
Part III: EXPERIMENTS ON THE EFFECT OF
TUNED DAMPING DEVICES ON FLEXURE-
AILERON FLUTTER. C. Scruton, D. V. Dunsdon
and P. M. Ray. 1952. 31p. diagrs., 5 tabs.
(ARC R & M 2559. Formerly ARC 8581; ARC 9946;
ARC 9882)

In part I, a general theory has been developed for
the investigation of the influence of damping devices
of various types on flexure-aileron flutter. The
numerical applications refer to a large transport
aircraft, and they are restricted to the case of a
mass-balanced aileron-carried damper. From
the diagrams given at the end of the part, it is
inferred that this type of damper would be unsatis-
factory as a flutter preventive. Part II supplements
part I and gives results for a partly balanced and for
a completely balanced aileron-damper system. It
is concluded that tuned dampers of these types would
also prove unreliable. Part III describes an experi-
mental investigation into the effect on flexure-aileron
flutter of a tuned damping device attached to the
aileron. The results confirm the theoretical con-
clusion that the use of an aileron-carried damper
would not be a reliable flutter preventive.

N-21805*

Aeronautical Research Council (Gt. Brit.)
COMBUSTION IN THE GAS TURBINE - A SURVEY
OF WAR-TIME RESEARCH AND DEVELOPMENT.
Peter Lloyd. 1952. 45p. diagrs., 8 tabs. (ARC
R & M 2579; ARC 11,435. Formerly Power Jets
Research and Development, Ltd. Special Rept. 510)

The present report attempts a general survey of the
whole field of gas-turbine combustion. The report
covers both research and development, and while
it is mainly concerned with British work, some
mention is also made of German work on the same
subject. The related processes of combustion in
propulsive ducts are briefly touched on. The report
is based on a paper to the Institution of Mechanical
Engineers, but with much fresh material, including
a comprehensive bibliography. There have been
many groups of investigators concerned in this work
at the Royal Aircraft Establishment, Power Jets,
Joseph Lucas and Co., the Asiatic Petroleum Co.,
Metropolitan Vickers Ltd., Rolls-Royce, Armstrong
Siddeley's, De Havillands and the City and Guilds
College. In preparing the present report, full use
has been made of the work of all these groups and of
the Combustion Panel of the Ministry of Aircraft
Production's Gas Turbine Collaboration Committee
through which they cooperated; this debt is gratefully
acknowledged. On the other hand, the interpreta-
tion and assessment of the work are the author's,
and for these full responsibility is taken.

N-21806*

Aeronautical Research Council (Gt. Brit.)
THE LAMINAR BOUNDARY LAYER ASSOCIATED
WITH THE RETARDED FLOW OF A COMPRESSI-
BLE FLUID. C. R. Illingworth. 1953. 23p.
diagrs., 4 tabs. (ARC R & M 2590. Formerly
ARC 9886; FM 975)

Two aspects of the solution of the equations
governing steady gas flow in a laminar boundary
layer, when the main stream velocity is nonuniform,
are considered. In the first place, it is shown that
the equations can be reduced to ordinary differential
equations, whose solution implies the similarity of
the distributions of velocity and temperature in
planes perpendicular to the boundary, only in the
case when the main stream velocity is uniform. In
the second part, an extension of Pohlhausen's method
is used to determine the point of separation of the
boundary layer in an air flow in which the pressure
increases with a uniform gradient.

N-21807*

Aeronautical Research Council (Gt. Brit.)
THE ASYMPTOTIC THEORY OF BOUNDARY-LAYER
FLOW WITH SUCTION. PART I: THE THEORY
OF SIMILAR VELOCITY DISTRIBUTIONS. PART II:
FLOW WITH UNIFORM SUCTION. PART III: FLOW
WITH VARIATION OF SUCTION VELOCITY. E. J.
Watson. 1952. 45p. diagrs., 13 tabs. (ARC
R & M 2619. Formerly ARC 9906; FM 977; ARC
10,025; FM 993; ARC 10,317; FM 1063; ARC
10,852; FM 1148)

The subject of this report is the steady two-
dimensional flow of a boundary layer over a
permeable surface through which the fluid is with-
drawn at a known rate of suction. This rate of
suction is assumed, in accordance with the
hypotheses of the boundary layer, to be small com-
pared with the stream velocity, and of order $R^{-1/2}$,
where R is the Reynolds number. It is supposed
here that the suction is relatively large, though still
of the same order. Part I deals with the similar
solutions of the boundary-layer equations, part II
with an arbitrary pressure distribution but constant
suction velocity, and part III with the general
problem.

N-21808*

Aeronautical Research Council (Gt. Brit.)
SANDWICH CONSTRUCTION AND CORE
MATERIALS. PART IV. Section I: 'BALSOLITE'
IMPREGNATED PAPER CELLULAR MATERIAL AS
AN ELASTIC STABILISER. W. J. Pullen.
Section II: COMPRESSION TESTS ON SANDWICH
PANELS WITH 'BALSOLITE' CORES. R. G.
Chapman and S. Pearson. Section III: STRENGTH
TESTS OF A TYPHOON TYPE FUSELAGE OF
'BALSOLITE' SANDWICH CONSTRUCTION. J. K.
Oaks. 1952. 18p. diagrs., photos., 5 tabs.
(ARC R & M 2687; 10,212. Formerly ARC 7267;
Strut 746; Plas. 45; RAE SME 268; RAE Test
Note 122)

A range of struts each consisting of "Balsolite"
filler sandwiched between two faces of 1/16-inch
thick birch plywood has been tested in order to
assess the efficiency of Balsolite as a stabilizer in
sandwich structures. It is concluded that this
material compares favorably with other low density
materials when used as a stabilizer. Modification
of the material, namely the use of transverse and
longitudinal tubes alternately, does not appear to be
beneficial.

N-21809*

Aeronautical Research Council (Gt. Brit.)
SOME INVESTIGATIONS ON THIN NOSE-SUCTION
AEROFOILS. J. Williams. Part I: A COMPARI-
SON OF THE STALLING PROPERTIES OF SOME
THIN NOSE-SUCTION AEROFOILS. Part II: A
THEORETICAL INVESTIGATION ON THIN HIGH-
LIFT AEROFOILS SPECIALLY DESIGNED FOR
NOSE-SLOT SUCTION. 1952. 28p. diagrs., 10
tabs. (ARC R & M 2693. Formerly ARC 11,560;
Perf. 455; FM 1255; ARC 12,144; Perf. 528;
FM 1334; ARC 13,090)

In part I, the experimental results from stalling
tests on thin nose-suction airfoils are compared and
the design features of the tested airfoils are
analyzed. The airfoils include the 8-percent-thick
Lighthill and Glauert sections specially designed for
nose-slot suction, the 8-percent-thick H.S.A. V
section with distributed suction through a porous
nose, and some conventional sections of moderate
thickness tested in Germany with slot suction at
various positions on the nose. Part II describes
a theoretical exploration of possible thin nose-slot

airfoils specially designed to have an abrupt fall in velocity where suction is to be applied on the upper surface of the nose.

N-21810 *

Aeronautical Research Council (Gt. Brit.)
TANK TESTS ON A JET-PROPELLED BOAT-
SEAPLANE FIGHTER (SAUNDERS-ROE E6/44).
G. L. Fletcher. 1952. 31p. photos., diagrs., 6 tabs. (ARC R & M 2718; ARC 9404. Formerly RAE Aero 2106)

Investigations into porpoising stability, water resistance, and seaworthiness have been made on the hull design of the E6/44. The original lines were unsatisfactory for seaworthiness and porpoising stability at overload and modifications to improve these qualities have been made. Results on the final lines indicate that porpoising stability should be adequate at all loads up to the design overload, and take-off time should be well within the specified limit. Seaworthiness tests show that the limiting condition for satisfactory operation at normal load is a 2-foot sea. The hump spray is severe and, due to likelihood of damage, full advantage of flaps may not be gained unless a preselector control is used.

N-21811*

Aeronautical Research Council (Gt. Brit.)
THE SCOPE AND ACCURACY OF VORTEX LATTICE THEORY. V. M. Falkner. 1952. 30p. diagrs., 16 tabs. (ARC R & M 2740. Formerly ARC 12,743; Perf.607)

This report gives an outline of the development of the principles on which potential problems in lifting-plane theory are solved by the use of a vortex lattice for the purpose of computing downwash. The conditions of convergence necessary for an accurate solution are defined, and the main purpose of the report is to show that those connected with the lattice have been, or can easily be satisfied.

N-21812 *

Aeronautical Research Council (Gt. Brit.)
FLUTTER AND DIVERGENCE OF SWEPT-BACK AND SWEPT-FORWARD WINGS. A. W. Babister. 1953. 13p. diagrs. (ARC R & M 2761; ARC 13,391. Formerly College of Aeronautics, Cranfield, Rept. 39)

In this note, the equations of the flexural-torsional flutter of a swept wing are established, assuming the wing to be semirigid and fixed at the root. The general effects of sweepback, wing stiffness, and position of the inertia axis are determined. The critical speeds for flutter and for wing divergence are determined (1) for incompressible flow and (2) for compressible flow, applying the Glauert correction. The critical flutter speed is, in general, higher for a sweptback wing having the same wing stiffness as the unswept wing; for a sweptforward wing, divergence will occur before flutter.

N-21813 *

Aeronautical Research Council (Gt. Brit.)
A METHOD OF PERFORMANCE REDUCTION FOR HELICOPTERS. F. O'Hara. 1952. 12p. diagrs. (ARC R & M 2770; ARC 11,062. Formerly AFEE Res. 26)

The equations for helicopter performance are derived in a form suitable for the development of performance reduction methods, and the equations obtained provide also a simple method of performance estimation. Formulas are determined for reducing observed performance data to standard temperature conditions and for estimating the effect of weight changes on performance. Charts of the relationships are given for typical values of helicopter and engine characteristics. The general equations are divided into two groups dealing, respectively, with forward and vertical flight. Performance reduction methods are then outlined for the three cases of climbing, level, and vertical flight and are applied to show the effect of weight changes in each case.

N-21976 *

Ministry of Supply (Gt. Brit.)
A GRAPHICAL METHOD FOR THE RAPID ESTIMATION OF HELICOPTER PERFORMANCE. A. Armitage. January 1953. 25p. diagrs. (Ministry of Supply. RD(H)/F. 20/1)

A method of rapid estimation of helicopter flight performance is presented, with nomographic charts which save much time in calculation, for example, up to 75 percent of that taken by other current methods. The method is based on familiar helicopter theory, and was originally evolved by Capt. R. N. Liptrot when head of the department. It has now been revised and extended to cover such aspects as vertical rate of climb, and tip stall at high forward speed. The working charts have also been prepared and are included. The charts are particularly useful in rapid assessment of the worth of new projects, and in estimating the effect of varying one or more design parameters of both new and existing designs. Only standard parameters and three special factors are employed. The method compares favorably with other accepted methods. A specimen calculation performed on an actual helicopter, together with the comparable flight test values, is included as an appendix.

N-21977 *

National Gas Turbine Establishment (Gt. Brit.)
CONVECTIVE HEAT TRANSFER IN A VORTEX CHAMBER. D. G. H. Higgins. December 1952. 24p. diagrs. (NGTE R.127)

This report describes convective heat-transfer measurements made on a parallel walled "cyclone" vortex chamber, embracing the variables of chamber size, mass flow, inlet temperature, and inlet velocity, and establishes a correlation between Nusselt number and Reynolds number for that portion of the vortex flow unaffected by inlet and outlet

conditions, from which heat-transfer coefficients
between gas and wall may be estimated. A curve
is given showing the effect of inlet and outlet condi-
tions on this correlation and suggested methods of
computing the heat-transfer coefficients in these
regions are included. The coefficients so obtained
are for the convective component of heat transfer
only, radiation effects being neglected in the tests
since no combustion of fuel took place within the
test chamber itself.

N-21978 *

Royal Aircraft Establishment (Gt. Brit.)
A PULSE-OPERATED AUTO-CORRELATOR. F. W.
Stoneman. December 1952. 18p. diagrs. (RAE
Tech. Note GW 225)

A pulse-operated auto-correlator offers advantages
over other forms of correlator in its comparative
simplicity and its ability, under certain conditions
of use, to provide a complete correlogram without
the necessity of recording the input data. The
system involves the storage of information on a
series of condensers connected to the contact banks
of two uniselectors, the wipers of which can be
rotated at the same speed but with any desired
angular separation, equivalent to the required values
of τ, the correlation interval. Theoretically the
results obtained are accurate for a repetitive
function if the sampling rate is more than twice the
highest frequency component. A test instrument has
been built which demonstrates that the principle is
sound, and provides the basis of a practical machine.
The main difficulties requiring further investigation
are listed in the conclusions.

N-21979 *

Aeroplane and Armament Experimental Establish-
ment (Gt. Brit.) GROUND POWER CHECKING OF
HELICOPTER ENGINES. TESTS WITH A
HOVERFLY 1. D. A. Wilkinson. August 29, 1952.
12p. photos., diagrs., tab. (AAEE/Res/268)

A preliminary investigation has been made on a
Hoverfly 1 of the possibility of ground checking the
power of helicopter engines. Tests have been made
with both standard blades and blades fitted with
attachments. These tests confirm that power checks
which involve tethering are unsatisfactory and
indicate that power checks should be made under low
lift conditions. Two methods of achieving this con-
dition were investigated, one using lift spoilers at
high pitch, and the other using drag plates at low
pitch. The latter method proved to be the more
satisfactory and appears to provide a practical solu-
tion, without undue handling problems, by which
power variations of the order of 2 percent could be
detected. This method may be suitable for use by
qualified ground crew provided that precautions are
are taken to prevent the occurrence of dangerous
blade motions.

N-23023 *

Aeronautical Research Council (Gt. Brit.)
THE SOURCE DISTRIBUTION REPRESENTING
SUPERSONIC FLOW PAST SLENDER BODIES OF
REVOLUTION HAVING DISCONTINUITIES IN THE
BOUNDARY GRADIENT. L. J. Morton.
November 21, 1951. 14p. diagrs. (ARC 14,436;
FM 1633)

The distribution of source strength along the axis,
based on the linearized equation, which represents
supersonic flow over a body of revolution is deter-
mined for a body having a discontinuity in the
boundary gradient. The method consists of a step-
by-step process which is applicable when the shape
of the boundary is not easily expressible in an
analytical form, and formulas are given for the
velocity components and change in pressure at the
discontinuity.

N-23024 *

Aeronautical Research Council (Gt. Brit.)
A SIMPLE AND ACCURATE METHOD FOR
COMPARING MANOMETERS. J. H. Preston.
June 8, 1951. 7p. diagr. (ARC 14,072; TP 340)

It is shown that the simple device of a water-sealed
reservoir enables a constant pressure difference to
be applied to the manometers under comparison.
Effects due to temperature changes in the reservoir
and the interaction of the adjustment of one manom-
eter on the indication of the other are negligible
compared with the observed effects when a complete-
ly closed reservoir is used. A theoretical explana-
tion of this is given. The readings of two manom-
eters can be compared with an accuracy which is
limited only by the sensitivity of the manometers and
the amount of zero creep due to room temperature
changes.

N-23025 *

Aeronautical Research Council (Gt. Brit.)
EXPERIMENTS ON TWO-DIMENSIONAL SUPER-
SONIC FLOW IN CORNERS AND OVER CONCAVE
SURFACES. N. H. Johannesen. January 29, 1952.
20p. diagrs., photos. (ARC 14,607; FM 1669)

Two simple cases of two-dimensional supersonic
flow were investigated by schlieren photography,
namely the flow in two consecutive corners and the
flow over a circular-arc profile concave to the
stream. The flows were photographed for smooth
and rough surfaces of the models, that is, with
laminar and turbulent boundary layers, and the
observed flow patterns are compared with those
predicted by inviscid theory. The flow with a turbu-
lent boundary layer was in good agreement with
inviscid theory outside the boundary layer, whereas
the laminar boundary layer separated and a shock
wave originated at the point of separation. In both
cases, the agreement was good at points far from
the surface. A discussion is given of the flow at
the point of intersection of three shock waves, and
of a shock wave and a centered compression. For
the latter case, photographs show a weak shock
wave in the direction of the downstream Mach line
at the point of intersection.

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NACA
RESEARCH ABSTRACTS NO. 4 3

N-23036 *

Aeronautical Research Council (Gt. Brit.)
THE FLOW IN THE THREAT OF A SUPERSONIC
EFFUSER. W. F. Cope and R. O. Gibson.
August 23, 1951. 10p. diagrs. (ARC 14,214;
FM 1595)

The velocity profiles have been calculated for two
radii of curvature and two values of γ for each
radius. They are considerably affected by the radius
and hardly at all by γ. Comparison with Hermann's
results suggests that his "X shocks" may be a
supersaturation phenomenon. It is proposed to
calculate the flow further down the effuser by includ-
ing more terms of the series for the velocity
potential and using a boundary curve which has a
point of inflection.

MISCELLANEOUS

NACA Rept. 1071

Errata No. 1 on "THEORETICAL SYMMETRIC
SPAN LOADING DUE TO FLAP DEFLECTION FOR
WINGS OF ARBITRARY PLAN FORM AT SUBSONIC
SPEEDS." John DeYoung. 1952.

NACA TN 2890

Errata No. 1 on "A LINEAR TIME-TEMPERATURE
RELATION FOR EXTRAPOLATION OF CREEP AND
STRESS-RUPTURE DATA." S. S. Manson and A.
M. Haferd. March 1953.

NACA TN 2922

Errata No. 1 on "THE DESIGN OF VARIABLE MACH
NUMBER ASYMMETRIC SUPERSONIC NOZZLES BY
TWO PROCEDURES EMPLOYING INCLINED AND
CURVED SONIC LINES." Clarence A. Syvertson
and Raymond C. Savin. March 1953.

NACA TM 1317

Errata No. 1 on "A SIMPLE NUMERICAL METHOD
FOR THE CALCULATION OF THE LAMINAR
BOUNDARY LAYER." K. Schröder. April 1953.

UNPUBLISHED PAPERS

N-18009 *

TEMPERATURE VARIATION AND TEMPERATURE
STRESSES IN PLATE AND SHELL-SHAPED BODIES.
PART 1. (Temperaturverlauf und Tempera-
turspannungen in platten - und schalenformigen
Korpern). K. Marguerre. January 1953. 22p.
diagrs. (Trans. from Ingenieur-Archiv, v. 8,
June 1937, p. 216-228)

The following bases for a theory of the heat stress
on plate (or shell-shaped) bodies are investigated:
the (purely thermal) differential equations for the
variation of certain mean values of temperature and
the (thermoelastic) differential equations for
stretching and bending of the plate exposed to a
change in temperature.

N-22617 *

MACHINE TOOL CONTROL FROM A DIGITAL-
ANALOG COMPUTER. Harry W. Mergler,
George J. Moshos and Allen E. Young. 1952. 25p.
diagrs., photos. (Presented at American Institute
of Electrical Engineers meeting, Albany, New York,
October 29-31, 1952)

This report describes the development of automatic
machine tool controls for the use in fabrication of
turbine blades. The following are described: (1) a
technique for preparing the coordinate of dimensional
data describing the profile to be machined in the
form of punched card intelligence, (2) a device to
interpolate between these discrete data points to
generate a continuous profile represented as a
mechanical position, and (3) a servo system duplicat-
ing this mechanical position at a high power level to
drive the coordinate controls of a machine tool.

N-22876 *

National Bureau of Standards.
PROTECTIVE VALUE OF SURFACE TREATMENTS
FOR MAGNESIUM ALLOYS. Fred M. Reinhart.
December 1, 1952. i, 31p. photos., 5 tabs.
(National Bureau of Standards. Rept. 2026)

This report presents the results of a study of the
relative efficiencies of various surface treatments
for magnesium alloys with respect to their ability to
improve the adherence of paint and thus improve the
general corrosion resistance of these alloys when
exposed to marine atmosphere and tidewater
environments. The protective value of eleven
different painted surface treatments on three types
of magnesium alloys in salt fog, marine atmosphere
and tidewater environments were determined.

TECHNICAL FILM

NACA Technical Film No. 26 *

NACA CRASH-FIRE RESEARCH. 1 reel, 1600 ft.
sound and color.

This film covers full-scale aircraft crashes which
were made to investigate the mechanism of the start
and development of aircraft crash fires. This
investigation revealed the characteristics of the
ignition sources, the manner in which the combus-
tibles spread, the mechanism of the union of the
combustibles and ignition sources, and the pertinent
factors governing the development of crash fire as
observed in this program.